in these departments, we find that the oldest of kindred institutions abroad have been in existence but a third of the century, and yet have taken rank with the first institutions of science, and have greatly enriched its literature with the results of their inquiry and discovery. Entering at once upon their labors, and enjoying the fruits of their successes, we have before us in our country, and upon our own continent, a field from which we should gather fruit for exchange with the whole world of science. If our national vanity makes us jealous even of foreign exploration upon this continent, our national pride, and the just and liberal enterprise of science, should lead us to perform that work for the benefit of mankind. We should demonstrate to the world that republicanism and filibusterism are not identical; and that royal patronage and hereditary wealth are not necessary for the culture of a scientific spirit. With such a field, and such a work before us, we confidently invite the co-operation of our fellow citizens. We open our rooms to the scholar, the merchant, the philanthropist, to each and all without distinction of school or sect. In seeking the advancement of this Society, we are seeking the honor of our city and country. If the day shall come when the American Geographical and Statistical Society shall occupy a building of its own, its ample halls adorned with the historical maps, and the most recent surveys, its library furnished with all that science and travel can supply in its department, and its statistical bureau with all reliable information duly classified, and freely proffered to the editor, the merchant, the manufacturer, the physician, the statesman, and the philanthropist,—they who have built the structure shall win the grateful honor of their generation, and bequeath to posterity a deathless legacy of fame.

TEXAS.

The value of taxable property in Texas has been increased as follows: In 1850 it was $53,563,671; in 1852, $80,754,094; in 1854, $126,981,617; in 1856, $161,504,026; and in 1858, $192,287,377.

GEOLOGY OF NEW JERSEY.*

The principal geological formations in New Jersey cross the State in a N. E. and S. W. direction. The rocks which are so prominent upon the upper part of New York island, and which underlie the whole of it, extend on toward the S. W., appearing on Diamond Reef, just off the Battery, then at the quarantine landing on Staten Island, and again a few miles this side of Trenton, on the Delaware, whence they extend across Pennsylvania, Delaware, and Maryland, and on farther south. The line following this range across New Jersey, divides the State into two parts, each of which possesses very marked and peculiar geological features. In studying the geology of the northern region, it may be considered as divided into three parts:

1. The primitive region, embracing its central part, which is the extension of the Highlands.

2. The region lying on the north-west, constituting what is known as the Kittatinny Valley and the Blue Mountains.

3. The S. E. border of the northern division, which is characterized by the red sand-stone as the principal rock, and the ridges of trap which traverse it in various directions.

The primary region toward the N. E. is remarkable for its mountains and for the irregular and broken character of its surface. It seems to be made up of continuous ridges, which are separated by narrow valleys. The passage across the country is laborious, and the promise for agricultural improvement extremely poor. Toward the S. W. the valleys become wider, limestone and other secondary rocks are found, and large portions are noted for their agricultural wealth.

The rock is metamorphic, usually intermingled with gneiss; its strata are highly inclined, and in almost all cases dip toward the S. E. There are several localities, where white limestone is

* Outline of remarks made by Prof. J. H. Cook, of Rutger's College, New Jersey, before the Am. Geo. and Stat. Soc., on the organization of the Section on Geology, Jan. 28, 1858.

found in connection with the gneiss. One near Mottville, is remarkable for the beautiful specimens of asbestos and serpentine, which accompany it, and the belt of white limestone, which extends along near the S. E. base of Pochneck, Mt. Pimple hill, and the lower hills beyond. This limestone is interesting to the mineralogist for the many rare and beautiful minerals found imbedded in it. It is especially remarkable for containing the only known localities of red oxyde of zinc now extensively used in the manufacture of white paint. Whether this limestone is of the same age with the gneiss, or whether it is altered from the blue limestone is a question, on which there is some difference of opinion among geologists. In several of the valleys a blue limestone is found, which, from its fossils, is evidently the Black River limestone of the New York system. Professor Rodgers advanced the opinion that it was newer than the coal formation, but from the silurian fossils found in the rocks adjacent to it, there seems good reason for placing it among the older silurian strata. The occurrence of these fossiliferous rocks in the midst of a primary region, and their lying in a highly inclined position in the valleys—indicate the powerful elevating and disturbing forces which have operated upon them. This region is rich in iron ore of an excellent quality. The ore is found over a large portion of the belt, more abundant in the central and northern parts than in the southern and western. They are, however, not continuous veins. Some of them appear upon the surface for a few feet or rods only, while others may be traced for a mile or more. The veins vary in thickness from a few inches to 60 and 70 feet, and the same vein varies in thickness in different places. In dip they conform to the rock in which they lie; and irregularities in thickness and terminations of the veins, instead of taking a vertical or any uncertain direction beneath the surface, uniformly descend toward the north-east.

It has been found by a careful examination of the structure of these veins, that the supply of ore which can be obtained from them will never cease by exhaustion—but will continue till the cost of raising it to the surface exceeds its value. It gives new interest to this region, lying as it does, at our very doors, that it offers an almost inexhaustible supply of this indispensable metal. The origin of these ores, though apparently a purely speculative question, is one which has important practical bearings, and a correct theoretical knowledge of their origin will aid much in opening and working the mines. The quality of iron made from these ores is much superior to that obtained abroad; and in quantity, according to the statement of Dr. Kitchel, capable of yielding a million of tons a year for many years to come. Dr. Kitchel advances the opinion that these mines of ore or veins, are of a sedimentary origin, like the rocks in which they are found, and that with those rocks they have since been changed in structure, appearance, and perhaps in composition. Bischof endeavors to explain the formation of magnetic iron ore by chemical action. Starting with the fact that many common rocks contain oxyde of iron, some enough to make 28 per cent. of the magnetic ore, he goes on to reason that this is a source sufficient to furnish an amount vastly beyond that found deposited in veins, and that no great stretch of imagination is needed to supply the chemical force, which would bring these disseminated particles of iron from the rock in which they are imbedded, and collect them in the veins or strata of ore.

The district lying to the north-west of the State is a broad and elevated valley lying between the Blue Mountain and the Highland ranges, extending from the New York State line on the north-east, to the Delaware on the south-west. This beautiful country is known as the Kittatinny Valley. Its rocks principally belong to the Black River and Hudson River formations of the New York survey. It is a rich agricultural and grazing district. The geological formation most prominent here is the same as in the rich grazing districts of Orange, Dutchess, Columbia, Rensselaer, Washington, Herkimer, Lewis and Jefferson counties in this

State, and it is equally noted with those counties for the quantity and quality of its dairy products. Passing from the north-west to the south-east, we come upon a region widely different. Its principal rock consists of red shale and sandstone, with intruded veins and ridges of trap traversing it in various directions. It covers nearly half the northern division of the State, and is part of the extensive formation much developed in the valley of the Connecticut river, through almost the whole of the States of Massachusetts and Connecticut; appears again on the Hudson a little below Stony Point, and extends onward south-westerly across all the States to South Carolina. The Richmond coal field is in this rock, and also the Deep River coal field of North Carolina. The precise equivalent of this formation to the rocks of Europe, has been the subject of spirited discussion among our prominent geologists, Professors Rogers, President Hitchcock, the Messrs. Redfield, Dr. Emmons and others, for a number of years. It is well known to be more recent than our coal formation. Some new fossils recently discovered by Dr. Emmons, have done much to strengthen the opinion advanced by him that they are of the age of the Trias. The difficulty of the case arose from the extreme scarcity of fossils in the rocks. In New Jersey, indistinct remains of plants are not uncommon in the red sandstone quarries, and very distinct impressions of fishes have been found at Pompton and Boonton in this rock. Fossil footmarks, so abundant and remarkable in the red stone of the Connecticut Valley, have never been found in this formation in New Jersey. Thin seams of coal have been met with in several localities, but not in quantity to encourage mining for it. The dip of this rock is toward the north-west—just the reverse of that of the formations lying on either side of it—and this circumstance has been the cause of much speculation in regard to its deposition. The belt in its broadest part is more than twenty miles wide, and has a dip from 10 to 20 deg. to the north-west. The trap rock which forms the abrupt ridges, so characteristic of the surface of this formation, has not materially disturbed the dip of the red sandstone. Slight chemical changes have been effected in some localities, by which copper or its ores have been collected at the junction of the two rocks. This is the case at Somerville and at Belleville also. This region is rich in agricultural wealth and development. It abounds in lovely scenery.

The southern division of the State is but little elevated. The Neversink and a few other hills rise to the height of nearly 350 feet; and the central elevation or backbone of the district has an average height of about 200 feet; but so gentle are the variations of surface, that one can pass entirely across the State without being conscious of any elevation whatever. The prevailing soil is more or less sandy, and the vegetation such as is peculiar to light soils. There is a total absence of extended rock formations; all the materials found even in boring wells to the depth of 300 or 400 feet, are soft and earthy in character.

Passing over the State from the N. W. to the S. E., as in the section from Trenton to Long Branch, we cross those which are successively higher, until we arrive at those which are now in process of formation. These successive strata belong to three distinct geological periods. Commencing at the N. W. border, the several strata of plastic and marly clays, of green sand and feruginous sand, belong to the cretaceous formation. The central or S. E. portions of the district belong to the quartenary system of the N. Y. geologists—drift or diluvium constituting all of it except the sand beaches along the shore, the tide marshes and a fringe of upland bordering them, which belong to the alluvial or recent formation.

CRETACEOUS FORMATION.

The lowest stratum of the cretaceous formation has much economical importance from its containing extensive beds of pure and fine potters' clay. These clays have evidently been formed from the disintegrated material of the gneiss rock, which has been before pointed out at Trenton, and in the same line at Staten Island and which, I have no doubt, once formed

a continuous ridge between these two points. At Trenton the quartz, mica, and decomposed feld-spar, or Kaolin, are found lying together upon the solid gneiss rock. In other places, as at Woodbridge and on Staten Island, the mixed materials are found and no rock near them—and in many other places the materials are found as they have been sorted by the action of the water—quartz in the condition of sand in one place—mica in another, and the Kaolin or clay, in still another. It is rare that so fine an exhibition of the origin of white clay is to be seen. The best qualities are obtained at Woodbridge, South Amboy and Trenton. The trap ridge in the centre of the State, and the heavy deposits of diluvium south of it, have buried the clays so deep that none are exposed there. An immense quantity is consumed every year in the manufacture of fire brick. Clay for the common varieties of pottery is also taken from this formation; and a small quantity is also used in the manufacture of fine porcelain. The black clay which lies immediately over the white is a stratum of no economic importance, except as it furnishes the basis for an excellent soil. It contains few, if any, animal remains in its lower bed, but trunks and branches of trees are very abundant. The upper part of this clay contains scattering grains and small masses of green sand; and shells, teeth, and other animal remains indicating that a new order of things, is found.

The succeeding formation is characterized by containing beds of a peculiar mineral substance called "*green-sand.*" It appears in small grains like gunpowder, usually some shade of green in color, and so soft that it can easily be crushed upon the thumb nail. Its composition is complex, principally a silicate of iron, aluminum, magnesia and potash. Its fertilizing power has been ascribed to the potash, and to the carbonate and phosphate of lime, which it contains. All these doubtless contribute to its value; those containing the largest per centage of phosphate of lime are most esteemed. The formation is evidently of marine origin; it is filled with the remains of such animals as inhabited the sea. Shells somewhat resembling those of the oyster are abundant. Bones of saurians, turtles and fish, are common. In all cases, however, they are of extinct species. To the theoretical geologist it is extremely interesting, as filling up an interval wanting in the geological series in Europe, and showing that instead of there being an entire destruction of animals at the close of the cretaceous period, and a new creation at the beginning of the tertiary, there was a gradual dying out of the older forms, and an equally gradual introduction of the new ones, and that while this change was going on, cretaceous and tertiary forms were living in the same waters at the same time. The green sand occupies three narrow belts on the N. W. and S. E. of the State; it is so exposed, that its advantages are experienced over a belt of country 20 miles wide and 90 miles long. The whole formation appears to have been elevated to its present height by some force which was very uniform in its action. Not the slightest disturbance is to be perceived, and yet it must have been thus elevated, for its fossils are evidently of marine origin. This fact in regard to the fossils can only be explained by supposing that these strata have been elevated more upon their north-western, than upon their south-easterly edges, and thus brought to their present inclined position. The green sand is most exposed upon sloping grounds, especially on the banks of streams, and this has given rise to very erroneous notions in regard to its position. It is thought by many that it has been formed in the valleys of streams, and in no other localities. Now that a correct knowledge of its geological position has been obtained, enterprises for diffusing its benefits over a more extended area are planned or in operation, with promising prospects of success. The amount of this fertilizer which is accessible, is immense. A square foot of surface will yield a ton, an acre 43,650 tons, and a square mile more than 27 million tons.

There are a great many square miles of it. The occurrence here of this immense and much needed supply of fertilizing matter, brought

from the deposits of the sea, is an interesting example of that compensating action which is going on in every department of the material world. Chemists tell us that the air of our atmosphere is kept in a state of almost uniform purity by the reciprocal action of plants and animals upon it. Carbonic acid, which is rejected from our lungs as worthless and even poisonous, is the food of plants, and they are continually taking it from the atmosphere to to supply the materials for their growth; the carbonic acid is decomposed, its carbon becomes part of the vegetable structure, and its oxygen returns to the air to render it pure and wholesome. In the aquarium, the balance of animal and vegetable life is so adjusted that with no supplies from without, both forms maintain a healthy existence, each supplying what the other needs for food, and removing that which, if accumulated, would become hurtful. The action of geological agencies in bringing from the ocean that which seems lost, is another example of the same kind, with only the difference that the vibration of the balance is longer. Rains and other causes are continually carrying the elements of fertility from the soil to the streams, and so on to the sea, and immense quantities of the richest of the soil are carried away, apparently to be lost forever. But in the progress of geological change they are again brought to the surface, once more to bring back fertility to the wasted soil, and verdure to the exhausted fields.

The whole country has been benefitted by the presence of this bed of fertilizing green sand. The fine crops produced by its use have stimulated farmers to greater exertions; better systems of husbandry have been adopted, and now that they have tasted the profits of good farming, progress is visible in every direction.

The large tract lying to the south-east of the green sand has hitherto been an unpromising field for geological as well as for industrial pursuits. The prevailing soil is light or gravelly, the timber pine, or a scrubby growth of oak. Another portion comprises the strip bordering on the Atlantic shore and Delaware Bay. Its width in some places is only a few rods, in others several miles. That portion of it which is dry upland, closely resembles the older formation on which it lies, and is distinguished from it only by the greater fineness of the earth, and by containing remains of trees and of shells of species still common in the vicinity. The striking peculiarity of the case is that they should be found so much out of place. Shells unchanged in appearance, and bearing every mark of being in the places where they lived and died, are found at various elevations up to 10 or 12 feet above high water mark, and imbedded in earth as dry and solid as any other upland soil. Stumps and trunks of trees are found in similar condition, some buried below the present tide level, and others above it. The soil being formed from the washings of that above it, is among the most productive in the State.

The low sandy islands or banks, or beaches as they are commonly called, standing immediately upon the ocean, also belong to this formation. They extend along the whole of our Atlantic shore, and are to be found on Delaware Bay and Sandy Hook. These beaches are composed entirely of fine white sand. They rise from two to thirty feet above high water, the average being not more than eight or ten feet. Some of them are bare sand, but most are covered with bushes and trees. On the side next the ocean the sand is in the form of rounded or irregular hillocks—but on the opposite side, and in some cases over a large part of their surface, it is arranged in long narrow ridges, which, though only three or four rods in breadth, and 10 or 12 feet high, extend unbroken the whole length of the beach, which is several miles. This peculiarity of surface exists on all the beaches. It can be seen on Sandy Hook, but it is not so prominent a feature there as upon the beaches opposite Cape May. The ridges are covered with old and heavy timber, and are usually designated as the "Old Beach." The hillocks, covered with a younger and much lighter growth, constitute "Young or Little

Beach." The beaches undergo no changes of importance on the side next the marsh or upland. The higher flow of the tides is killing the timber on the lower parts, and salt grass now grows where bushes or trees formerly flourished. But the changes are slight. On the sea side, where they are exposed to the full force of the wind and waves, they are rapidly wearing away. Every year the hillocks are drifting in and the beaches growing narrower. In some places the sea has broken entirely across them, and the sand is spread out upon the surface of the marsh. A singular fact connected with their extension in length is worthy of notice.

The beaches below Great Egg Harbor, and all, I presume, below Barnegat, are continually extending at their S. W. extremities. The sand points which they put out gradually crowd the inlet before them, until it comes close to the N. E. end of the next beach, when the sea breaks over the point at the original location and a new inlet is formed, which again travels over the same space. The beaches on Long Island also extend themselves westward, but Sandy Hook and those next south of it, extend in the opposite direction. The point of the Hook is said to have increased in length over a mile within the last hundred years. In the early maps of the Hook, it is represented as being a point of the Highlands, and Shrewsbury and Neversink rivers run directly out to the ocean. In 1778, the sea broke through between Sandy Hook and the Highlands, and the former became an island. The extension of the land beaches above Long Branch continued to force the mouth of Shrewsbury river further and further North, until in 1810 they closed it entirely, and the only outlet for the river was between the Highlands and Sandy Hook. In 1830, the sea opened a passage across the beach near the former mouth of the river. This inlet, as it was called, was continually shifting its place moving always toward the North till in 1848 it was a mile North of its original position. In that year it was closed and has remained so ever since. A correct theory of the origin of these beaches and a full exposition of the changes they are undergoing, are needed. *A modifying control of their causes would do much to improve the navigation in the principal approach to this city.*

Between the beaches and the upland is a large extent of *tide marsh.* This, too, is of a very recent date—indeed it is rapidly forming now. Occupying the comparatively quiet space behind the beaches, and still penetrated in every direction by channels and thoroughfares which admit the ocean water freely, aquatic plants of every kind find congenial situations and thrive. Mud is deposited among them, and thus a sod is formed which continually keeps its upper surface at the level of high water, and pushes its edges farther and farther into the sounds and bays.

The marsh not only encroaches on the water surface, but appears also to be gaining on the upland. Shallow as it is seen to be on the margin, and with the upland rising by a very gentle slope, it requires but a slight rise in the water to carry it forward over a considerable breadth; and in this respect, very marked changes have been observed since the first settlement of the country. Numerous places are known, where upland trees formerly grew, which are now covered by the salt marsh, and on which no fresh water plants can grow. And roots, and in some cases, trunks of trees, are frequently found where they grew, which are now several feet below the level of high tide and buried in marsh mud. This encroachment is to be noticed wherever the marsh meets the upland or the beaches. The same fact is equally marked on Long Island and on the shores of Chesapeake bay.

These facts all go to show that now, as in the preceding periods of geological time, motion and not rest is the condition of the earth's surface —that our own shores are undergoing a gradual subsidence, a change so slow that its effects are not seen in a year or even in a score of years; but in a life time, is well marked in the advance of marsh upon upland, in the increased power of the sea to wear away the land, and in the deepening of open channels.

Upon the conclusion of this paper, Ex-Governor Horatio Seymour proposed a vote of thanks to Prof. Cook for his admirable paper. He alluded to the importance of the study of geology, and related some remarkable and very interesting facts, regarding the early history of the British settlers, showing where, with the proper appreciation of geological knowledge, fortunes have been made, and want or disregard of that knowledge has been attended with enormous losses.

EXPLORATION OF THE ROCKY MOUNTAINS IN THE BRITISH POSSESSIONS.

At a recent meeting of the Royal Geographical Society, a paper was communicated by Sir E. Bulwer Lytton, Colonial Secretary, giving the results of the explorations of the Rocky Mountains lying in the British Possessions, made by Capt. Palliser, under the direction of the British Government. The paper states that several practical passes had been discovered leading through the mountains, which are enumerated as follows:

1, from the south branch of the Saskatchawan to Kutanie river, two—*i. e.*, Kananaski Pass and Vermillion Pass; 2, from Kutanie River to Columbia, two—*i. e.*, the Lake Pass and Beaver Foot Pass; 3, from the south branch of the Saskatchawan to north branch, one—*i. e.*, the Little Fork Pass; and 4, from the south branch of the Saskatchawan to the Columbia one—*i. e.*, the Kicking Horse Pass. In addition to these discovered passes, the Northern Kutanie Pass has been laid down, and found to be entirely within the British territory, and has been named British Kutanie Pass. After the reading of these highly important papers, the President, in commenting upon the reports which had been read, reminded the Fellows that the expedition was fostered in the first instance by the Geographical Society, and that they had therefore great reason to be proud of successful results as those which had attended it. After briefly alluding to the praiseworthy efforts made by Palliser and his associates, Hector, Blackiston and Sullivan, in a preceding year, in defining the nature of the great region between Lake Superior and Lake Winnipeg, and thence extending to the Red River Settlement, (a region also explored by men of science sent thither by the Canadian Government,) he begged the gentlemen who might be disposed to speak, to confine their attention chiefly to the last discoveries, which indicated, first, the rich quality of the soil over a vast prairie country, watered by the upper affluents of the north and south Saskatchawan River, and next the existence of passes through the Rocky Mountains within the British Territory—*i. e.*, between 49 deg. and 51½ deg. north latitude, which had been for the first time examined by men of science, who had determined the geographical position, the relative altitudes of the mountains, and their mineral characters. He pointed out that it was a remarkable and satisfactory *datum* that, although in this portion of its range the chain rose to much loftier summits than in its prolongation to the south, the depressions, or passes, in it were now shown to be about 2,000 feet lower than those by which the Americans can travel into the central parts of California. After adverting to the great interests which necessarily attached to these discoveries in relation to the establishment of a line of intercourse between the great eastern or Atlantic watershed of British North America and the newly established colony of British Columbia, with its gold fields on *terra firma*, and the great coal deposits of Vancouver's Island on the Pacific, he hoped that persons who had long studied the subject, such as Mr. John Ball, lately of the Colonial office; Mr. Edward Ellice, who had so much knowledge of British North America, and so large a stake therein; Lord Bury, who had recently returned from that country, &c., would address the meeting. Mr. Ball and Lord Bury having spoken at some length, the President, in adjourning the meeting, stated that Sir E. B. Lytton, had not only kindly communicated the despatches which had been read, but had further acceded to the request of Capt. Palliser and Dr. Hector that they might be permitted to return to England next summer, revisiting the passes they had discovered, and exploring British Columbia on their road to the shores of the Pacific.

It is to be regretted that the elevation of the above described passes was not given absolutely instead of by comparison with those over which Americans pass on the central route between the Eastern States and California. One of these, called the Cochetope, is 10,000 feet above the sea. The passes lying next to this, both north and south, are elevated 8,000 feet; so that if those discovered by Capt. Pallisser are 2,000 feet lower, still they are equally elevated as the pass on the line of the